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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR		ATTORNEY DOCKET NO.
09/055,201	04/03/98	BROWN	W	933.P1/MXP/R

IM61/0823

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EXAMINER	
ZERVIGON, R	

ART UNIT	PAPER NUMBER
1763	8

DATE MAILED: 08/23/99

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

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Office Action Summary	Application No. 09/055,201	Applicant(s) Brown, W., Herchen, H., Welch, M.D.
	Examiner Rudy Zervigon	Group Art Unit 1763

☐ Responsive to communication(s) filed on ______.

☒ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire *3* month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) *1-12, 14-16, and 24-36* is/are pending in the application.

Of the above, claim(s) ______ is/are withdrawn from consideration.

☐ Claim(s) ______ is/are allowed.

☒ Claim(s) *1-12, 14-16, and 24-36* is/are rejected.

☐ Claim(s) ______ is/are objected to.

☐ Claims ______ are subject to restriction or election requirement.

Application Papers

☒ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on ______ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on ______ is ☐approved ☐disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☒ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☒ received.

☐ received in Application No. (Series Code/Serial Number) ______.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: ______.

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). ______

☐ Interview Summary, PTO-413

☒ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

DETAILED ACTION

Drawings

1. The proposed drawing correction and/or the proposed substitute sheets of drawings, filed on April 30, 1999 are found acceptable.

Response to Arguments

2. Applicant's arguments with respect to amended claim 1 have been considered but are moot in view of the new ground(s) of rejection. Refer to the new grounds of rejections necessitated by amendment A below.

3. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relied, specifically, "..a microwave energy applicator to couple microwaves to the effluent flowing through the exhaust tube to reduce the hazardous gas content of the effluent." are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

4. Applicant's arguments filed April 30, 1999 with respect to claim 2 have been fully considered but they are not persuasive. Chiu (U.S. Pat. 4,735,633) clearly anticipates the original, unamended, claim limitations of claims 1 and 2. No recirculating is required by Chiu because of the geometric

design of the treatment apparatus geared towards establishing sufficient residence time of the toxic gas in the treatment apparatus. The residence time of the toxic gases in Chiu's treatment apparatus is well demonstrated in the calculation sheet employing the <u>cited</u> numbers in the Chiu patent.

5. In response to applicant's argument that the references fail to show certain features of applicant's invention, embodied as claim 6, it is noted that the features upon which applicant relies, specifically, "Itoga et al do not teach or suggest a microwave energy applicator to energize the effluent flowing through an exhaust tube..." is not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

6. Applicant's arguments with respect to claim 7 have been considered but are moot in view of the new ground(s) of rejection.

7. In response to applicant's argument that the references fail to show certain features of applicant's invention, embodied in claims 10, 27-30, it is noted that the features upon which applicant relies, specifically, "... a microwave energy applicator to couple microwaves to the effluent in the exhaust tube to energize the effluent." are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

8. Applicant's arguments with respect to claims 10, 11, 12, 14, 24-30 have been considered but are moot in view of the new ground(s) of rejection.

9. In response to applicant's argument, concerning claims 9, 15, 16, 24, 26 that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies, specifically, "... a microwave energy applicator to couple microwaves to the effluent in the exhaust tube to energize the effluent." are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Claim Rejections - 35 USC § 102

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

11. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

12. Claims 1-2, 11, 31, 33 are rejected under 35 U.S.C. 102(b) as being anticipated by Randall S. Mundt (U.S. Pat. 5,137,701). Randall S. Mundt describes an apparatus and method for eliminating unwanted materials from a gas flow line (title). The apparatus of which can be used to treat effluent gas from semiconductor processes (column 1, lines 22-24; column 2 lines 66-68; column 3, lines 1-2; column 4, lines 64-68). Additionally, Randall S. Mundt implicitly does not require a

reflux line for his apparatus (item 10, Figure 1) which is positioned between a process reaction (item 12, Figure 1) and a vacuum pump system (item 14, Figure 1). Because no recycle line exists upstream or downstream of the vacuum pump system back to the flow line 22 representing the inlet pipe to the treatment apparatus, then Randall S. Mundt implies that a recirculation of the processed gas is unnecessary.

Claim Rejections - 35 USC § 103

13. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

14. Claim 3-5, 8, 9, 11, 12, 14, 32, 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Randall S. Mundt, as applied to claim 1 above, and further in view of Kin-Chung Chiu (U.S. Pat. 4,735,633). Randall S. Mundt describes an apparatus and method for eliminating unwanted materials from a gas flow line (title). The apparatus of which can be used to treat effluent gas from semiconductor processes (column 1, lines 22-24; column 2 lines 66-68; column 3, lines 1-2; column 4, lines 64-68). Randall S. Mundt does not make specific reference to a residence time in the processing reactor of the gas to be treated. However, Randall S. Mundt does allow for an apparatus design including a baffle member (item 60, Figure 1; column 6, lines 52-55). Baffles are well known apparatus components for allowing a fluid to effectively mix and/or have enhanced residence time within the processing stream.

Chiu discloses an exhaust system apparatus, plasma extraction reactor (lines 66-68, column 2), for treating effluent gas streams from plasma processes (Figures 1-6). Chiu specifically applies the plasma extraction reactor to utility in the removal of vapor phase environmental contaminants from effluent gas streams generated by semiconductor processing equipment generating plasma states (line 61-68, column 2). Chiu also discloses the location of his plasma extraction reactor relative to a CVD process (lines 1-18, column 6) and more specifically to a GENUS Model 8402 LPCVD reactor (lines 53-58, column 8). Chiu discloses an embodiment where radio frequency driven parallel electrode plates, as part of the plasma extraction reactor, are positioned to intercept effluent gas from the upstream production site and subsequently deposit the gas on the electrode surfaces by nucleation (line 61-68, column 2 through, lines 1-7, column 3, lines 18-23, column 5). Variations on contact area of the reacting effluent are considered and integrated into the design by altering the geometry of the flow path (lines 24-45, column 3). Among the geometric design considerations of the internal flow chamber put forth by Chiu include a flow path length to ensure sufficient removal of the effluent gas (lines 24-30, column 3), a high ratio of electrode area to reactor volume (lines 11-23, column 3), electrode surface area to flow rate of gas to be optimally set for vapor removal capacity (lines 30-37, column 3). According to the following demonstration, the requirement that the flow path be of sufficient length to provide an effluent gas residence time of at least 0.01s in the exhaust plasma extraction reactor stipulated in claim 3 is implicitly satisfied under the teachings of Chiu[1]. Chiu does not explicitly make reference to the flow regime, either turbulent or laminar, when passing

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[1]Refer to the Examiner's calculation sheet.

the effluent gas through the plasma extraction reactor. Chiu also does not explicitly make reference to the surface characteristics of the flow path. However, because Chiu discusses variations of the internal flow chamber geometry as well as flow characteristics of the effluent gas in the range of values outlined in lines 8-45 column 3 Chiu is implicitly favoring laminar, unhindered, flow of the effluent gas through his plasma extraction reactor. Any author describing internal fluid flow, such as Chiu, would consider that the direction of fluid flow (velocity vector), substantially distant from the boundary layer, and the tangent to the surface of the encasement are an implicitly parallel. Chiu does point out that in order to reduce the size of his plasma extraction reactor, the processing pipe can be convoluted (lines 57-62, column 4) as apposed to the larger processing space required for a linear plasma processing apparatus. Projections or recesses, beyond boundary layer variability, are also implicitly taught by Chiu under the observation that the geometric design considerations of the internal flow chamber and flow rates for sufficient removal put forth by Chiu (lines 11-37, column 3) would have to be reinvestigated/recalculated if projections or recesses were present in Chiu's plasma extraction reactor. Figures 1-6 also support flow surfaces absent of projections and or recesses.

It is the examiner's position that a person of ordinary skill in the art at the time the invention was made would have found it obvious to modify the Randall S. Mundt baffle geometry by altering its relative dimensions to resemble the Kin-Chung Chiu baffle system and, thus, as was demonstrated in the Examiner's calculations sheet (provided as an attachment to the first Office Action) provide "...residence time of the effluent flowing through the exhaust tube that is at least about 0.01

seconds." because such a geometric alteration would increase the well recognized residence time in the reactor flow path.

15. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Randall S. Mundt (U.S. Pat. 5,137,701) as applied to claim 1 above, and further in view of Itoga et al (JP51-129868, STIC translation provided). PTO document 99-0412 provided as a translation of the cited Japanese reference provides specific examples of introducing a *reagent gas mixture* as an oxidizing agent (page 2, last paragraph) with the effluent stream from a semiconductor industry apparatus effluent in a plasma environment (Page 1).

It is the examiner's position that a person of ordinary skill in the art at the time the invention was made would have found it obvious to modify the Randall S. Mundt ballast gas by introducing oxidants as taught by Itoga et al because such would have been anticipated to produce an expected result.

16. Claim 7, 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Randall S. Mundt as applied to claims 1 and 2 above, and further in view of Labib et al (U.S. Pat. 5,426,000). Labib et al demonstrate the common industrial application of sapphire, mono or polycrystalline, in refractory applications under high chemically corrosive environments with high temperatures as present in plasma gas (column 1, lines 45-55; claims 1 and 2).

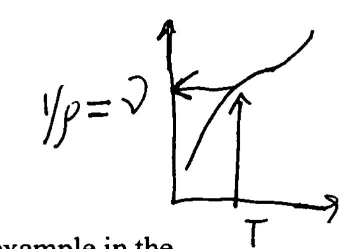
It is the examiner's position that a person of ordinary skill in the art at the time the invention was made would have found it obvious to modify the plasma facing quartz tube material of Mundt (column 3, lines 49-53; column 7, lines 22-25, 1-2) by selecting industrial standard alternative

refractories, as demonstrated by Labib et al, because such an interchange of refractory material would have been anticipated to produce an expected result.

17. Claims 10, ~~16~~, 24, 26, 27, 28, 29, 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Randall S. Mundt. The claim 10 limitations are obvious over Randall S. Mundt under the following observations:

a. "The gas analyzer capable of monitoring the hazardous gas content.." is obvious according to the pressure sensor (item 36, Figure 1), which measures total pressure, and provides a signal of total pressure to the system control (item 44, Figure 1). With the example reaction provided by Randall S. Mundt in column 8 and elementary thermodynamic equations, the concentration of the hazardous gas content is extracted (in this example carbontetrachloride):

$$x_{CCl_4} = 1 - \frac{P_{CO_2}}{P_{Tot}} = \frac{\dfrac{\rho_{CO_2} RT}{42 g CO_2 / mol - CO_2}}{P_{Tot}}$$



The density of carbon dioxide as a function of temperature is well known (for example in the bottling industry) and commonly listed in thermodynamic tables. Power is controlled by the system control (item 44, Figure 1). The process termination is additionally inherently described provided that control valve (item 16, Figure 1) is closed. Although the pressure sensor (item 36, Figure 1) is located upstream of the plasma reaction chamber, a person of ordinary skill in the art would consider

the placement of or the addition of another pressure sensor on the effluent side of the reactor to be an obvious variant over the design of Randall S. Mundt.

It is the examiner's position that a person of ordinary skill in the art at the time the invention was made would have found it obvious to modify the placement of the pressure sensor (or addition of another pressure sensor) downstream of the reaction chamber because such pressure sensor location selection would have been anticipated to produce an expected result.

18. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Randall S. Mundt as applied to claims 10, ~~16~~, 24, 26-29 above, and further in view of Kin-Chung Chiu (U.S. Pat. 4,735,633). Chiu discloses an exhaust system apparatus, plasma extraction reactor (lines 66-68, column 2), for treating effluent gas streams from plasma processes (Figures 1-6). Chiu specifically applies the plasma extraction reactor to utility in the removal of vapor phase environmental contaminants from effluent gas streams generated by semiconductor processing equipment generating plasma states (line 61-68, column 2). Chiu also discloses the location of his plasma extraction reactor relative to a CVD process (lines 1-18, column 6) and more specifically to a GENUS Model 8402 LPCVD reactor (lines 53-58, column 8). Chiu discloses an embodiment where radio frequency driven parallel electrode plates, as part of the plasma extraction reactor, are positioned to intercept effluent gas from the upstream production site and subsequently deposit the gas on the electrode surfaces by nucleation (line 61-68, column 2 through, lines 1-7, column 3, lines 18-23, column 5). Variations on contact area of the reacting effluent are considered and integrated into the design by altering the geometry of the flow path (lines 24-45, column 3). Among

the geometric design considerations of the internal flow chamber put forth by Chiu include a flow path length to ensure sufficient removal of the effluent gas (lines 24-30, column 3), a high ratio of electrode area to reactor volume (lines 11-23, column 3), electrode surface area to flow rate of gas to be optimally set for vapor removal capacity (lines 30-37, column 3). According to the following demonstration, the requirement that the flow path be of sufficient length to provide an effluent gas residence time of at least 0.01s in the exhaust plasma extraction reactor stipulated in claim 3 is implicitly satisfied under the teachings of Chiu[2]. Chiu does not explicitly make reference to the flow regime, either turbulent or laminar, when passing the effluent gas through the plasma extraction reactor. Chiu also does not explicitly make reference to the surface characteristics of the flow path. However, because Chiu discusses variations of the internal flow chamber geometry as well as flow characteristics of the effluent gas in the range of values outlined in lines 8-45 column 3 Chiu is implicitly favoring laminar, unhindered, flow of the effluent gas through his plasma extraction reactor. Any author describing internal fluid flow, such as Chiu, would consider that the direction of fluid flow (velocity vector), substantially distant from the boundary layer, and the tangent to the surface of the encasement are an implicitly parallel. Chiu does point out that in order to reduce the size of his plasma extraction reactor, the processing pipe can be convoluted (lines 57-62, column 4) as apposed to the larger processing space required for a linear plasma processing apparatus. Projections or recesses, beyond boundary layer variability, are also implicitly taught by Chiu under the observation that the geometric design considerations of the internal flow chamber and flow rates

[2]Refer to the Examiner's calculation sheet.

for sufficient removal put forth by Chiu (lines 11-37, column 3) would have to be reinvestigated/recalculated if projections or recesses were present in Chiu's plasma extraction reactor. Figures 1-6 also support flow surfaces absent of projections and or recesses.

It is the examiner's position that a person of ordinary skill in the art at the time the invention was made would have found it obvious to modify the Randall S. Mundt baffle geometry by altering its relative dimensions to resemble the Kin-Chung Chiu baffle system and, thus, as was demonstrated in the Examiner's calculations sheet (provided as an attachment to the first Office Action) provide "...residence time of the effluent flowing through the exhaust tube that is at least about 0.01 seconds." because such a geometric alteration would increase the well recognized residence time in the reactor flow path.

19. Claim 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over as applied to claims 10, ~~16~~, 24, 26, 27, 28, 29, 35 above, and further in view of Kin-Chung Chiu (U.S. Pat. 4,735,633). Randall S. Mundt describes an apparatus and method for eliminating unwanted materials from a gas flow line (title). The apparatus of which can be used to treat effluent gas from semiconductor processes (column 1, lines 22-24; column 2 lines 66-68; column 3, lines 1-2; column 4, lines 64-68). Randall S. Mundt does not make specific reference to a residence time in the processing reactor of the gas to be treated. However, Randall S. Mundt does allow for an apparatus design including a baffle member (item 60, Figure 1; column 6, lines 52-55). Baffles are well known apparatus components for allowing a fluid to effectively mix and/or have enhanced residence time within the processing stream.

Chiu discloses an exhaust system apparatus, plasma extraction reactor (lines 66-68, column 2), for treating effluent gas streams from plasma processes (Figures 1-6). Chiu specifically applies the plasma extraction reactor to utility in the removal of vapor phase environmental contaminants from effluent gas streams generated by semiconductor processing equipment generating plasma states (line 61-68, column 2). Chiu also discloses the location of his plasma extraction reactor relative to a CVD process (lines 1-18, column 6) and more specifically to a GENUS Model 8402 LPCVD reactor (lines 53-58, column 8). <u>Chiu discloses an embodiment where radio frequency driven parallel electrode plates, as part of the plasma extraction reactor, are positioned to intercept effluent gas from the upstream production site and subsequently deposit the gas on the electrode surfaces by nucleation (line 61-68, column 2 through, lines 1-7, column 3, lines 18-23, column 5)</u>. Variations on contact area of the reacting effluent are considered and integrated into the design by altering the geometry of the flow path (lines 24-45, column 3). Among the geometric design considerations of the internal flow chamber put forth by Chiu include a flow path length to ensure sufficient removal of the effluent gas (lines 24-30, column 3), a high ratio of electrode area to reactor volume (lines 11-23, column 3), electrode surface area to flow rate of gas to be optimally set for vapor removal capacity (lines 30-37, column 3). According to the following demonstration, the requirement that the flow path be of sufficient length to provide an effluent gas residence time of at least 0.01s in the exhaust plasma extraction reactor stipulated in claim 3 is implicitly satisfied under the teachings of Chiu[3].

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[3]Refer to the Examiner's calculation sheet.

Chiu does not explicitly make reference to the flow regime, either turbulent or laminar, when passing the effluent gas through the plasma extraction reactor. Chiu also does not explicitly make reference to the surface characteristics of the flow path. However, because Chiu discusses variations of the internal flow chamber geometry as well as flow characteristics of the effluent gas in the range of values outlined in lines 8-45 column 3 Chiu is implicitly favoring laminar, unhindered, flow of the effluent gas through his plasma extraction reactor. Any author describing internal fluid flow, such as Chiu, would consider that the direction of fluid flow (velocity vector), substantially distant from the boundary layer, and the tangent to the surface of the encasement are an implicitly parallel. Chiu does point out that in order to reduce the size of his plasma extraction reactor, the processing pipe can be convoluted (lines 57-62, column 4) as apposed to the larger processing space required for a linear plasma processing apparatus. Projections or recesses, beyond boundary layer variability, are also implicitly taught by Chiu under the observation that the geometric design considerations of the internal flow chamber and flow rates for sufficient removal put forth by Chiu (lines 11-37, column 3) would have to be reinvestigated/recalculated if projections or recesses were present in Chiu's plasma extraction reactor. Figures 1-6 also support flow surfaces absent of projections and or recesses.

It is the examiner's position that a person of ordinary skill in the art at the time the invention was made would have found it obvious to modify the Randall S. Mundt means for reaction chamber effluent gas destruction in place for Chiu's RF energy applicator. Motivation for the alternative means of reaction chamber effluent gas destruction is drawn from potential differences in operating costs/efficiencies associated with microwave generators as apposed to electrode RF generators.

Conclusion

20. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

21. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (703) 305-1351. The examiner can normally be reached on a Monday through Friday schedule from 8am until 5pm. The official AF fax phone number for the 1763 art unit is (703) 305-3599. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (703) 308-0661.

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